Safety device for a fall restraint

The present invention relates to a safety device for a fall restraint, comprising anchoring means to which the fall restraint can be coupled directly or indirectly , and comprising fastening means for a firm and durable connection to an object.

Such a device is increasingly finding application, particularly on flat and sloping roofs of houses and buildings as fastening point for a fall restraint with which a person can hook him/herself during work to the roof or an outer wall of the structure in question in order to prevent falling hazard. This is first and foremost a result of the increasingly stringent regulations in respect of working conditions in which such work may be carried out. During work at height on a wall of an object the person wears a harness with safety line with which he couples him/herself fast to the anchoring member. It is noted here that within the scope of the invention the term wall should be understood in a broad sense, so that it should be understood to mean not only an outer wall but for instance also a roof of an object.

A safety device usually comprises a base from which a fastening eye or other anchoring member extends and which is permanently fixed to the object. An example of such a safety device is known from the American patent USP 5,287,944. The safety device described therein is fastened into the fixed construction of the object by means of a large number of screws and plugs. A corresponding number of holes are drilled for this purpose into the construction of the object at the set position. In this known safety device the fixing eyelet is formed as integral part with the base from sufficiently strong plate steel. Another example of a safety device is known from the American patent USP 5,687,535, wherein the fastening of a base thereof to the object takes place by means of one or several bolts which penetrate into the construction of the object for the purpose of a permanent fixed connection thereto. A separate fixing eyelet is in turn connected to the base by means of a nut and bolt connection.

Although these known anchoring devices provide per se a solid and reliable anchor point for a fall restraint, they also have significant drawbacks. Owing to the relatively rigid connection of the safety device to the construction of the object, a possible fall is

not absorbed thereby, or hardly so, so that the kinetic energy involved has to be absorbed wholly in the fall restraint so that it is not exerted on the falling person. Occasionally it is not possible to avoid the person suffering injury here. The attachment of the safety device in these known cases furthermore requires penetration of the object, which can have an adverse effect on the integrity of the construction thereof.

The present invention has for its object, among others, to provide a safety device of the type stated in the preamble with which these and other drawbacks are obviated to an at least significant extent.

In order to achieve the stated objective, a safety device of the type stated in the preamble has the feature according to the invention that the fastening means comprise a flexible fastening flap from which a fastening net extends, and that the anchoring means are connected via the fastening net to the flexible fastening flap. The safety device with the anchoring member is thus fastened to the object via the fastening flap and the fastening net. The fastening flap and the fastening net herein provide a certain shock absorption which can absorb at least a part of the kinetic energy in the case of a possible fall from the object, whereby personal injury is less serious.

Within the scope of the invention a wide variety of materials can in principle be applied for the fastening flap, with solid structure or openwork net or mesh structure. Particularly if the object is covered at least locally with a flexible wall-covering material, use can advantageously be made for the fastening flap of a flexible wall-covering material, and in particular of a bituminous or plastic roof-covering material. Owing to its inherent flexibility, such a wall-covering material provides a high degree of shock-damping in the case of a fall, which is already broken thereby to a certain extent. The momentum exerted on the body of a falling person is therefore limited.

The choice of material for the fastening flap in the form of a material which is the same as, similar to or at least significantly compatible with the material with which the object is covered at the location , furthermore simplifies the mutual connection between the

safety device and the object covering. Use is particularly made here of an attachment technique that is also used to arrange the local covering of the object. A further preferred embodiment of the safety device according to the invention has in this respect the feature that said firm and durable connection comprises a glue, fastening or welded connection. Not only is the person who normally arranges the wall covering familiar with this attachment technique, so that this person must also be deemed capable of arranging the safety device in reliable manner, such a glue, fastening or welded connection on the original covering of the object moreover leaves the integrity of the further construction thereof intact. In particular, no drill holes or other holes are therefore necessary in the wall or roof covering, which would otherwise involve the risk of leakages.

It has been found that with a sufficiently large free surface area of the fastening flap a sufficiently strong, reliable and durable connection can thus be realized. A particular embodiment of the safety device according to the invention herein has the feature that the fastening net is attached to the fastening flap or that the fastening net is integrated in the fastening flap. Such a connection of the fastening net to the fastening flap can be given a sufficiently strong form to resist a falling standard mass for a sufficiently long time. In order to avoid the net per se tearing inward or outward, a further particular embodiment of the safety device according to the invention has the feature that the fastening net is reinforced with longitudinal threads and transverse threads.

The safety device according to the invention will frequently find application on roofs on which a suitable roof-covering material from a roll is or will be applied. With a view hereto, a further preferred embodiment of the safety device according to the invention has the feature that the fastening flap forms part of an optionally unrolled roll of roof-covering material, and more particularly that the roof-covering material comprises a material from a group of plastic and bitumen. In such a case the safety device according to the invention can be arranged without additional processing steps in that it is realized en passant simultaneously with laying of the roof-covering. The incorporation of the fastening net in the complete roof-covering moreover has the advantage that mutual

connecting strength and distribution of forces are optimal. A further particular preferred embodiment of the safety device according to the invention has in this respect the feature that the fastening net is fixed to an inlay in the roof-covering material and is incorporated simultaneously therewith in the roof-covering material.

In order to already partially break an unexpected fall in the safety device and thus reduce a load on the body of the falling person, a further particular embodiment of the safety device according to the invention has the feature that the anchoring means comprise a resilient construction.

The invention will now be further elucidated on the basis of a number of exemplary embodiments and a drawing. In the drawing:

figure 1 shows a perspective view of a first exemplary embodiment of a safety device according to the invention;

figure 2 shows a cross-section of the device of figure 1;

figure 2A shows a cross-section of an alternative device of figure 1;

figure 3 shows a perspective view of a second exemplary embodiment of a safety device according to the invention;

figure 4 shows a cross-section of the device of figure 3;

figure 4A shows a cross-section of an alternative device of figure 3;

figure 5 shows anchoring means applied in a third embodiment of the safety device according to the invention;

figures 6A-B show the anchoring means of figure 5 in respectively a non-loaded and a loaded state; and

figure 7 shows a perspective view of a third exemplary embodiment of a safety device according to the invention.

The figures are otherwise purely schematic and not drawn to scale. Some dimensions in particular may be exaggerated to a greater or lesser extent for the sake of clarity. Corresponding parts are designated as far as possible in the figures with the same reference numeral.

A first exemplary embodiment of a safety device for a fall restraint according to the invention is shown in figures 1 and 2, respectively in perspective view and in cross-section. The device comprises strong anchoring means in the form of a fixing ring, eyelet or loop 1 member fastened to an outer end of a fastening net 12. The integrated fastening net 12 comprises a metal or plastic mesh or net which is reinforced with longitudinal and transverse threads in order to distribute forces exerted thereon over a greater area. Net 12 can have any desired shape and dimension, for instance round, square, polygonal or, as in this embodiment, triangular.

A standard fall restraint, for instance a safety line of a fall-arrest harness or safety harness, can be secured to fixing eyelet 1 in usual manner, for instance by means of a preferably locked karabiner hook or snap hook, in rapid and reliable manner. The device finds particular application for temporarily securing workpeople during operations at height on an object such as a house, apartment building or industrial installation. The device is connected permanently to the object for this purpose.

The anchoring member 1 is connected via fastening net 12 to fastening means in the form of a flexible fastening flap 11. With its relatively large surface area, fastening flap 11 provides an attachment base for a durable fixing of the safety device to an outer wall, roof or other wall of the object. In this embodiment fastening flap 11 forms an integral part of a roll 10 of flexible roof-covering material. This is more particularly a bituminous or plastic roof-covering material intended for fusing or glueing at an increased temperature to a similar roof covering such as applied on many flat and sloping roofs.

The arranging of the safety device on for instance a flat or sloping roof provided with a bituminous roof-covering can be carried out relatively simply and quickly with hardly any effect on the integrity of the original roof-covering. To this end the original roof-covering 13 is cleaned at the location and the roll of roof-covering material 10 with safety device 1,11 integrated therein is unrolled thereover. Using a conventional burner or hot-air drier the bituminous fastening flap 11 is then fused at increased temperature

with the existing, similar roof-covering to form a cohesive whole. Because there is in principle no penetration here through the original roof-covering, the watertightness and integrity of the whole remains ensured. In addition, it is possible to apply the safety device according to the invention via fastening flap 11 directly, i.e. on a bare surface, of an outer wall or roof. The invention provides in all cases the advantage that when the necessary roof-covering is arranged an effective fall restraint is also realized without affecting the integrity of the construction of the object as such or also interfering therewith.

What is important is a reliable connection between fastening net 12 and fastening flap 11, since this connection, just as that of the covering 10,11 to the surface, will be loaded during a fall. With a view hereto, use is made in the stated embodiment of an interweaving or other attachment of the fastening net 12 with an inlay 15 as is incorporated for strengthening purposes over the whole surface of the roof-covering material. Such an inlay 15 forms a strong yet flexible reinforcement of roof-covering material 10 which absorbs a lateral pull therein. Because this inlay extends over the whole surface of the roof-covering material, the load on the connection between fastening net 12 on the one hand and roof-covering material 10,11 on the other is distributed uniformly over the surface during a possible fall. The device of figure 1 is herein applied such that such a load occurs substantially in a direction as indicated by the arrow 5 drawn in figure 1.

Alternatively, fastening net 12 can also be connected to roof-covering material 10,11 in reliable manner by glueing the net 12 between two layers of roof-covering material 10,20 as shown in figure 2A. Other than incorporation in an inlay 15,25 of the roof-covering material, which must take place during production, such a fixing between two layers of roof-covering can also be realized later on-site.

A second embodiment of a device according to the invention is shown in figures 3 and 4. The device here also comprises a fastening flap 11 which forms an integral part of a roll 10 of roof-covering material. Extending from the device are anchoring means in the

form of a fixing ring or loop 1, which according to the invention are connected to roof-covering material 10,11 via a fastening net 12. Other than in the first exemplary embodiment, the fastening net in this embodiment is connected in diverse directions to the roof-covering material, so that the device can be loaded in different directions as indicated schematically in figure 3 with arrows 5. As in the foregoing embodiment, the attachment of fastening net 12 can here also take place to an inlay 15 received in roof-covering material 10,11, see figure 4, or by glueing between two layers of roof-covering material, see figure 4A.

Figure 5 shows a coupling 100 of a fall restraint which can be applied with a third exemplary embodiment of a device according to the invention. This embodiment substantially corresponds with the first embodiment, except that the anchoring means here comprises a mating coupling 110 complementary to coupling 100. Coupling 100 and mating coupling 110 can be snapped together so as to thus bring about a rapid-action coupling. Spring-mounted rollers or balls 105 herein snap into recesses 115 of the mating coupling intended for this purpose. Coupling 100 comprises release means (not further shown) with which snap members 105 can be forced manually out of recesses 115 in order to break the connection if desired.

Coupling 100 provides the anchoring means 110 with a resilient construction which during a fall can absorb a part of the falling force and thus spare the falling body. Figure 6A shows in this respect a damping spring 108 applied herein in released, non-loaded state, while figure 6B shows the same spring 108 in loaded, tensioned state, wherein a body is hanging from an outer end 101. As shown, this end 101 comprises a fixing ring, eyelet or loop to which a fall harness can be coupled. It is in addition possible to embody a safety line with the coupling 100 and then couple it directly to the safety device.

A third embodiment of a device according to the invention is shown in figure 7. A flexible fastening flap 11 here also forms an integral part of a roll of roof-covering material 10, the same as in the first and second exemplary embodiments of the device

according to the invention which have been described above. A fastening net 12 is situated centrally in roll 10 and is constructed in this embodiment solely from reinforced longitudinal threads extending over the full length of the roll. At regular intervals of about 2-3 metres a fixing eyelet or loop 1 is connected durably to net construction 12 so as to provide at regular intervals anchoring means to which a person can secure him/herself. Roll 10 can be unrolled and fixed over an existing roof-covering 13 or be applied directly as first roof-covering on a sloping or other roof.

The device according to the invention can in principle be applied on any structural type of roof or outer wall construction, wherein the strength of the construction is of secondary importance. Examples hereof are roof coverings or wall claddings of bitumen or plastic which are wholly or partially adhered, mechanically fixed or ballasted with loose material. The application of the safety device according to the invention complies with the EN 795 standard known to the skilled person. This standard describes the requirements for the testing methods for anchor provisions intended for personal protection against falls. The two essential points from the EN 795 standard are:

- a static test wherein a force of 10 kN can be resisted for 3 minutes in the direction in which the force can be applied during use; and
- a dynamic test wherein a mass of 100 kg, connected to the anchor point with a steel cable, is stopped in a free fall of 2500 mm.

Although the invention has been further elucidated above on the basis of only a number of exemplary embodiments, it will be apparent that the invention is by no means limited thereto. On the contrary, many variations and embodiments are still possible within the scope of the invention for a person with ordinary skill in the art. The invention can thus also be applied particularly with an individual fastening flap, i.e. separately of a roll of roof-covering material, wherein the fastening flap is attached individually to the object.

The different embodiments of the safety device for fall restraint according to the invention have in common that they are lightweight and can be mounted rapidly with simple means and tools. Specific to this safety device is that the force released during a

fall is absorbed in elastic manner by the materials from which the device is manufactured. When the occasion demands, a plastic deformation of one or more components of the device will absorb a significant part of the kinetic energy of a fall. The forces are then transmitted to the existing covering of the roof or the outer wall or to the roof or the outer wall itself.